

Remarks

On page 2 of the Office Action, claims 12-13, 15-17, 19-20, and 22-24 are objected to because the dependencies are labeled as being dependent upon canceled claims. Applicant herewith cancels the currently pending claims submits new claims 25-35. Applicant asserts that the new claims add no new matter. Accordingly, Applicant respectfully requests the Examiner withdraw the objection to claims 12-13, 15-17, 19-20, and 22-24 and respectfully request the Examiner reconsider new claims 25-35.

On pages 2 and 3 of the Office Action, claims 11-17 are rejected under 35 U.S.C. §102 (b) as being anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over Shibuta (U.S. Pat. No. 5,853,877). Applicants respectfully traverse the rejections, cancels the pending claims and submits herewith new claims 25-35 to assist in overcoming the rejections.

The new claims clarify the independent claims by providing that the oxidation of the outer wall is substantial. Support for this is found on page 3, lines 5-9 of the original specification. The substantial oxidation of only the outer wall of the multiwall carbon nanotube leads to an electrically insulating effect, wherein the outer wall loses its ability to conduct current. The conduction of electricity through the multiwall carbon nanotube is then automatically taken over by the next inner carbon nanotube. (See *also* page 3, lines 29-31.) Applicant asserts that the new claims do not add new matter.

To anticipate a claim, the reference must teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical

invention must be shown in as complete detail as is contained in the ... claim."

Richardson v. Suzuki Motor Co., 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Therefore, all claim elements, and their limitations, must be found in the prior art reference to maintain a rejection based on 35 U.S.C. §102.

Applicants respectfully submit that Shibuta does not teach every element of new independent claims 25 and 31, and therefore fails to anticipate claim either claim 25 or 31.

In Shibuta, hollow carbon microfibres obtained as microfibre agglomerations are chemically treated with a particular solution comprising a strong acid containing sulfur in addition to an oxidizing agent. The microfibres are treated until they are easily disentangled in a polar solution. The endpoint in treating the microfibres is judged by measuring the disappearance of nitrous acid. (Shibuta Col. 4, lines 30-34; Col. 5, lines 19-22.)

In contrast thereto, an object of the present invention is a process for substantially oxidizing only the outer wall of a multiwall carbon nanotube, so that this substantial oxidation of only the outer wall leads to an electrically insulating effect where that the outer wall loses its ability to conduct electric current and the conduction of electricity through the multiwall carbon nanotube is automatically taken over by the next inner nanotube.

This is accomplished with a method of functionalizing the outer wall of the multiwall carbon nanotubes by oxidation of a large number of the carbon atoms present

in this wall, i.e., a substantial oxidation, to generate chemically reactive groups. (p. 5, lines 31-34.) These groups are generated by reaction with a strong oxidizing acid. Strong oxidizing acids that may be used are nitric acid, sulfuric acid, chromic acid, Caro's acid, perchloric acid, iodic acid or organic per-acids. Further, it is possible to use sulfuric acid as a mixture with hydrogen peroxide. (p. 6, lines 10-21.)

A further object of the invention is to provide a multiwall carbon nanotube having an outer wall and at least one inner wall, wherein only the outer wall is substantially oxidized, so that this substantial oxidation leads to an electrically insulating effect so that the outer wall of the multiwall carbon nanotube loses its ability to conduct electric current, and the inner wall, or walls, are not oxidized, so that the conduction of electricity through the multiwall carbon nanotube is automatically taken over by the next inner nanotube.

This object of the invention is accomplished by substantially oxidizing only the outer wall of a multiwall carbon nanotube. Shibuta fails to disclose a process for substantially oxidizing only the outer wall of a multiwall carbon nanotube and further fails to disclose a multiwall carbon nanotube, wherein only the outer wall is substantially oxidized.

Shibuta is not faced with the technical problem addressed by the present invention and, as a result, fails to solve it as does the present invention. Shibuta neither teaches nor discloses the present invention. In light of the foregoing, Applicant respectfully requests reconsideration of new claims 25-35.

Turning now to the rejection of the claims as obvious under 35 U.S.C. § 103(a) over Shibuta, Applicant respectfully submits that, as discussed above, Shibuta fails to teach every element of new claims. Further Shibuta fails to suggest each element of the new claims and, therefore the present invention embodied in amended claims 25-35 is not obvious in view of Shibuta.

Three criteria must be met to establish a *prima facie* case of obviousness. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference. Second, there must be a reasonable expectation of success. Finally, the prior art reference, or combination of references, must teach or suggest all the claim limitations. MPEP § 2142. Applicants respectfully traverse the rejection since the prior art fails to disclose all the claim limitations and there would be no motivation to combine the references as proposed by the Examiner.

Shibuta discloses an electrically conductive transparent film comprising hollow carbon fibres and a method of making such a film. This film is made by treating carbon microfibrils with a strong acid containing sulfur and an oxidizing agent to form disentangled fibres and finally forming the film.

The technical problem addressed by the present invention is the construction of nanocircuits without an electric short circuit occurring between crossing multiwall carbon nanotubes. This technical problem is solved by a multiwall carbon nanotube, wherein only the outer wall is substantially oxidized. This problem is further solved by the inventive process for substantially oxidizing only the outer wall of a multiwall carbon nanotube. Shibuta neither teaches nor suggests the inventive solution.

For at least these reasons, Applicants submit that Shibuta fails to disclose every limitation in new claims 25-35. In light of the foregoing, Applicants respectfully request reconsideration of new independent claims 25-35.

On page 4 of the Office Action, claims 18-24 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Shibuta as applied to claims 11-17 above and further in view of Stephan et al. ("Doping Graphitic and Carbon Nanotube Structures with Boron and Nitrogen"). Applicant respectfully traverses this rejection and, as above, submits new claims to assist in overcoming the rejection.

As discussed above, Shibuta fails to disclose, teach or suggest all elements of new claims 25-35. Stephan discloses multiwalled carbon nanotubes having carbon atoms substitutionally replaced by boron and nitrogen atoms in varying amounts. Neither Stephan considered alone, nor the combination of Stephan and Shibuta teach or suggest a multiwall carbon nanotube doped with boron nitride wherein only the outer wall is substantially oxidized. Applicant respectfully submits that new claims 25-35 are not rendered obvious over Shibuta and in further view of Stephan.

Applicant respectfully requests the Examiner reconsider new claims 25-35 in light of the foregoing.

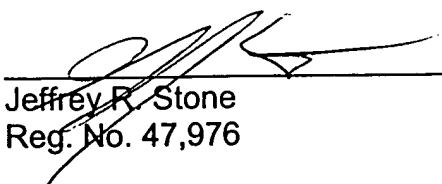
In view of the amendments and reasons provided above, it is believed that all pending claims are in condition for allowance. Applicants respectfully request favorable reconsideration and early allowance of all pending claims.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicants' attorney of record, Jeffrey R. Stone at (952) 253-4130.

Respectfully submitted,

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